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and

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JANUARY, 1943

## EDITORIAL

### 1943

In this, the first number of The Veterinary Journal for 1943, we extend to our readers the Season's Greetings. During 1942 The Veterinary Journal has been published, sometimes at irregular intervals and in some cases in the form of combined numbers. These departures from normal routine have been necessary for reasons over which we have had little control. War conditions have had some effects on many activities throughout the country and scientific periodicals have shared in the difficulties associated with publication. It is, however, a sure indication of the desire and ability of the nation to "carry on" under all conditions, that such periodicals continue to be published with such regularity and that authors find the time and have the inclination to continue to provide the necessary material.

During the coming year it is our resolve that The Veterinary Journal shall continue to appear in a form and at times as closely resembling pre-war days as prevailing conditions will allow. The Veterinary Profession must continue to practise the most satisfactory and up-to-date methods of maintaining the health and of controlling the diseases of livestock. It is essential that the results of new work and the experiences of all concerned are made known: this can be most readily accomplished through the medium of published articles. The Veterinary Journal will continue to serve its readers by the publication of such original articles and of information from all available sources.

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## General Articles

# THE NORMAL VARIATION IN THE HEART RATE OF DAIRY COWS

By K. L. BLAXTER,
*The National Institute for Research in Dairying, Shinfield, Reading*

THE heart rate or pulse rate of the individual dairy cow is generally assumed to vary within narrow limits providing that good health is maintained. The information which is available in the literature on heart rate variation is small, the older veterinary textbooks giving ranges of the order of 40-60 beats per minute. Fuller[1] quotes much of this literature and on the basis of his own observations gives the variation of the heart rate of dairy cows as high as 38-96 beats per minute. These figures do not apply to the variation met with in an individual but rather to the range in which most of the heart rates of healthy dairy cows fall.

Data on the variation in the heart rate of the same cow has been collected in connection with experimental work undertaken for another purpose, and the following preliminary results have been obtained.

### 1.—The effect of the nervous reaction of the cow on the heart rate

Preliminary observations had shown that the most reliable method of recording the rate of beat of the heart was by direct auscultation, as nervous movements of the cow resulted in many cases in the inability to hold surface arteries for a sufficient length of time to obtain a reliable record. The use of a stethoscope on the left chest wall obviated this difficulty, but there was, nevertheless, a nervous acceleration of the heart, which is apparent from the following records :

*Mean heart rates per minute of* 15 *cows*

| Time interval after stethoscope in position | Heart rate per minute |
|---|---|
| 1st half minute ... ... ... ... ... | 72.0 |
| 2nd „ „ ... ... ... ... ... | 67.6 |
| 3rd „ „ ... ... ... ... ... | 66.4 |
| 4th „ „ ... ... ... ... ... | 66.9 |
| 5th „ „ ... ... ... ... ... | 67.0 |

An initial high heart rate is apparent from these records. The final technique which was used in all subsequent heart rate recordings was to discount any initial nervous rise by allowing one minute to elapse following the placing of the stethoscope and then to count the number of first heart sounds occurring in 60 seconds. This technique has given good results in large-scale experiments where daily records were needed.

### 2.—The effect of body position on the heart rate

The heart rates of four cows which were accustomed to handling were taken during consecutive periods of standing and lying. Records which were taken when the cow was ruminating or eating in either position were discarded and the records which are given below are the mean rates calculated from five periods of standing and of lying. The heart rates for the cows when they were lying are

complicated by the fact that three of the cows were asleep during at least one lying period each. It is thought that this tends to increase the difference between the standing and lying rates.

*Mean heart rates in beats per minute*

| Cow No. | Heart rate standing | Heart rate lying | Decline in rate due to lying |
|---|---|---|---|
| 1 | 53.4 | 46.7 | 6.7 |
| 2 | 56.5 | 51.6 | 4.9 |
| 3 | 58.5 | 51.0 | 7.5 |
| 4 | 71.3 | 64.5 | 6.8 |

There is thus a drop in the heart rate when the animal is lying down amounting to five to seven beats per minute.

**3.—The effect of rumination on the heart rate**

Data from the same four cows was used to determine the effect of rumination on the heart rate. The mean figures in the following table were calculated from consecutive ruminating and non-ruminating records and apply to ten to fifteen records per cow :

*Mean heart rates in beats per minute*

| Cow No. | Heart rate when ruminating | Heart rate when not ruminating | Increase in rate due to rumination |
|---|---|---|---|
| 1 | 54.6 | 51.9 | 2.7 |
| 2 | 53.1 | 50.8 | 2.3 |
| 3 | 56.6 | 55.2 | 1.4 |
| 4 | 69.1 | 67.4 | 1.7 |

Rumination, therefore, has only a small accelerating effect on the heart rate, amounting to approximately two beats per minute.

**4.—The effect of ingestion of food on the heart rate**

If the heart rate is recorded at fifteen-minute intervals before, during and after feeding, it is found that there is a considerable increase in heart rate, a maximum being reached during the later stages of the consumption of the meal. The following data is calculated from such records on three cows, only maximal figures being given :

*Heart rates in beats per minute*

| Foods fed | Heart rate before meal offered | Maximum heart rate developed during feeding | *Increase* Beats per minute | Per cent. |
|---|---|---|---|---|
| 4 lb. of concentrates | 55.3 | 66.0 | 10.7 | 19.3 |
| 20 lb. of kale ... | 49.6 | 65.7 | 16.1 | 32.4 |
| 3 lb. of hay ... | 59.3 | 68.2 | 8.9 | 15.0 |
| 12 lb. of hay plus 20 lb. of kale ... | 54.3 | 90.2 | 35.9 | 66.1 |

This table shows that for heavy meals the increase in rate is very large but the increase is also shown by small meals, such as three pounds of hay. When eating finishes, the heart rate drops rapidly but does not necessarily reach its former level. In the case of the last meal in the above table, the rate one hour after it was all consumed was still 8 per cent. greater than it was before feeding.

Although all cows show acceleration of the heart during eating, some cows show a greater response than others, and on the basis of observation on other

cows it is not abnormal to find heart rates of over 100 per minute in the last stages of consumption of a heavy meal.

A 24-hour record of the heart rate of a dairy cow is therefore a highly variable record. Graphically, it is characterised by high peaks due to food ingestion and minor fluctuations due to variation in activity (standing *versus* lying and ruminating *versus* non-ruminating). There is also a continuous decline in the heart rate throughout the night of approximately one beat per minute per hour, with the result that the minimum heart rate occurs in the early hours of the morning. This decline is most probably associated with metabolism of the large meal at the end of the previous day, but other factors, such as sleep and environmental temperature cannot at the moment be excluded.

**Summary**

A preliminary study has been made on the variation of the heart rate of dairy cows and the following conclusions can be drawn :

(1) In taking heart rates with a stethoscope an initial high rate of beat must be discounted.
(2) Standing increases the heart five to seven beats per minute over lying.
(3) Rumination increases the heart rate by one to three beats per minute.
(4) Ingestion of large meals can cause increases of 66 per cent. in the heart rate, and even with small meals a comparatively large increase is found.
(5) Heart rates of over 100 beats per minute are not abnormal at the end of the ingestion of a large meal.

My thanks are due to Messrs. T. H. French, I. Sirry and R. Goble for their invaluable assistance in the collection of much of the data on which this report is based.

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## TRICHOMONIASIS IN THE BULL—II

By W. R. KERR,
*Veterinary Research Division, Ministry of Agriculture, Northern Ireland*

(*Concluded from page* 217, *Vol.* 98)

*Diagnosis*

The diagnosis of trichomonad infection in the bull is difficult and no easy method is available. The agglutination test (Kerr and Robertson, 1941), which gives good results in affected cows, fails to give the same results in the bull. This is probably due to the fact that the organisms are not present in the same concentration in the genitalia of the bull as they are in the uterus of the affected cows. Moreover, the genital mucous membranes of the bull do not seem to absorb the trichomonas antigen to a sufficient degree to induce the necessary agglutinin response in the blood. Several bulls have given a response of 13/9 index above normal but failed to reach the accepted low positive standard.

The methods of diagnosis may be summarised as follows :

1. Indirect method. Reliance is placed upon the clinical history of a large percentage of cows showing the characteristic symptoms of returning service, early abortions and of vaginal discharges following service by a certain bull.

In such a case indications are that the bull is the pivot of infection. This method is more reliable where an efficient stock register is maintained. In this method the use of the agglutination test is made possible by the testing of blood samples from mated cows. In one outbreak investigated the bull gave an above normal agglutination index of 12½/10, and of the seven cows mated by him five were found positive to the test.

2. The brush and canula method advocated by Abelein (1941). Some difficulty in carrying out this method may be experienced with temperamental bulls.

3. Direct examination of the genitalia under epidural anæsthesia. This is probably the most satisfactory method.

4. Mating method. This is carried out by mating the suspect bull to a virgin heifer. Subsequent examination is made daily of the vaginal discharge from the mated heifer. A positive result, as indicated by the presence of trichomonad parasites in the discharge, is satisfactory, but a negative result does not imply that the bull is free from infection.

**Treatment**

Certain problems arise in this connection and are discussed here.

In the case of the cow, restraint and the application of the necessary treatment are simple, but the contrary is the case in the bull owing to his greater strength and temperament, varying in different breeds. In general practice the difficulty of restraint without recourse to epidural anæsthesia is evident and constant attempts at treatment even with anæsthesia usually render him more intractable. Besides, from the economic aspect it is well-nigh impossible to carry out a series of epidural anæsthesia upon the same bull.

The difficulty of treatment is rendered greater by the complex nature of the genitals of the bull. If we accept the fact that the trichomonad invades the urogenital tract then we must accept the difficulties associated with the necessary irrigation of that tract. The value of urethral irrigation at all times is open to question in dealing with bacterial infections and there seems to be no reason why the same does not apply in irrigation for trichomonad infections. To be satisfactory it is essential that the drug in solution be of sufficient strength to destroy the organism completely without damaging the urethral mucosæ to such an extent that stricture may not follow as a sequel. Owing to the difficulties of application in the bull it is preferable that the end result be obtained by means of one or two irrigations. Recent treatment has been confined to the use of dyes. The action of dyes *in vitro* is relatively straightforward, but in the presence of tissue becomes complex. Dyes possess varying degrees of toxicity to enclosed tissue and may cause necrosis of the part.

The possibility also exists that the irrigating fluid may push the infection further up the tract. If the epididymis is invaded by trichomonads the possibility of successful treatment by irrigation is remote.

The multi-folds and crypts of the preputial sac make it a difficult site to flush efficiently, more particularly when the penis is at rest. The use of dye ointments advocated by certain workers may be more efficacious.

### Literature

Few workers have concentrated on the treatment of the bull. Swangard (1938), Dickmans and Poelma (1938) claim to have cured bulls by thorough application of a 0.5 per cent. trypaflavine salve to the penis and mucous membrane of the prepuce and by an injection into the urethra of 1 to 3 ounces of an 0.1 per cent. trypaflavine solution. This treatment is carried out under anæsthesia and again repeated in ten days. Abelein (1941) claims success using 0.5 per cent. acriflavine ointment for the preputial sheath and a 0.1 per cent. acriflavine solution for irrigating the urethra, and states that examinations made fourteen to twenty-one days later showed recovery. He also records the presence of some necrosis of treated parts which may occur as a sequel to this treatment. Stableforth and Gould (1937) recommend routine douching of the stock bulls with a 5 per cent. lactic solution.

### Resistance to Certain Therapeutic Agents

The literature in connection with the action of certain chemicals against *Trichomonas fœtus* is somewhat confusing and the results obtained by certain workers show wide variations and suggest a need for further investigation. Senna (1936), amongst his findings, states that the parasite is killed in one minute by 1/10,000 hydrarg. biniod, iodine 1/2,000, Lugol's solution 10 per cent. (0.1 per cent.?). Trypaflavin and entozoon took more than five minutes in high concentrations. Morisita (1939) found that 1/10,000 hydrarg, biniod and Lugol's fluid 1 x 64 (1/6.400?) did not kill in five minutes. He does not mention the use of dyes. The method adopted was to add one drop of the suspension of the parasite to one drop of the chemical solution and to observe the effects.

When formulating an experiment to determine the action of chemical solutions against *Trichomonas fœtus* a number of variable factors were taken into consideration in order to give comparable results. It was decided that:

(1) The single drop method would lead to deviations in the percentage dilutions and a minimum of 10 ccs. was therefore adopted as the basic quantity of solution to be tested.

(2) Normal saline be used in order to eliminate the isotonic effects upon the protozoa.

(3) The temperature of all solutions be constant throughout the test.

(4) Since it is accepted that organic matter seriously lessens the activity of most chemical agents, and since in the practice of irrigation the protein in the tissues and the induced outflow of mucin must affect the irrigant solution in a similar matter, some compromise in the test solution was necessary to give comparable results. For this reason 1 per cent. peptone in normal saline was decided upon.

(5) This factor is an extension of (4). The use of a heavy suspension of the organism introduces a certain amount of protein and it was found that a wide variation in results was produced by different densities of the organism. It was necessary, therefore, to fix the suspension to 100,000 organisms per cc. for all tests.

(6) The time factor introduces difficulties. Irrigation practice requires a fairly rapid action for this reason a one-minute reading was accepted as the most important. It was found especially in the testing of the dyes that in the

higher dilutions some 10 per cent. of the organisms resistant to the initial exposure remained active for a long time. Acid in the higher dilutions did not kill in one minute but by virtue of the H-ion concentration the organisms became immobilised in two to three minutes. At a pH. of 5 the trichomonad is sluggishly motile but remains alive, at a pH. of 4.5 or less death is rapid. As these tests were made at the same time the saline experiment constituted a control to the peptone experiment.

A reading at five minutes was included in the test.

The method finally adopted for the experiment was as follows:

(a) The required dilutions of the chemical agent to be tested were made up in tubes of 10 c.c. normal saline. At time of test 0.1 c.c. of a suspension of *Trichomonas fœtus* of known concentration was added to each tube and thoroughly mixed. One drop of the treated suspension was placed on a slide, cover slip affixed and effects noted.

(b) In the case of the 1 per cent. peptone water test it was thought necessary to add the chemical solution to each 10 c.c. prior to adding the suspension of organisms in order to standardise the action of the protein and the agent.

The effective curve of the results showed that the trichomonad after the initial exposure of the test solution passed through four phases:

(1) Excitation.
(2) Loss of forward movement.
(3) Movement only of undulating membrane.
(4) Immobilisation.

Cultures at phase (3) usually became actively motile after 30 minutes' incubation at 37 degrees Cent. Cultures made from phase (4) were negative and suggested that the organism had been killed.

Immobilisation was taken as the end point of the reading. $++++$ = completely motile, $+++$ = 75 per cent. motile, $++$ = 50 per cent. motile, $+$ = 25 per cent. motile.

| | *Dilution* | *Normal Saline Solution* | | *1 per cent. Peptone Saline Solution* | |
|---|---|---|---|---|---|
| | | 1 min. | 5 min. | 1 min. | 5 min. |
| Acriflavine | 1 per cent. | ———— | ———— | +——— | ———— |
| | 0.2 per cent. | ———— | ———— | +——— | ———— |
| | 0.1 per cent. | ———— | ———— | +++— | ++—— |
| | 0.02 per cent. | ++—— | ———— | +++— | +++— |
| | 0.01 per cent. | +++— | ++—— | ++++ | +++— |
| Brilliant Green | 1 per cent. | ———— | ———— | +——— | ———— |
| | 0.2 per cent. | ———— | ———— | ++—— | ———— |
| | 0.01 per cent. | ———— | ———— | +++— | +——— |
| | 0.02 per cent. | ++—— | +——— | +++— | ++—— |
| | 0.01 per cent. | +++— | ++—— | ++++ | ++—— |
| Different samples of Brilliant Green tended to give different results. | | | | | |
| Gential Violet | 1 per cent. | ———— | ———— | ++—— | +——— |
| | 0.2 per cent. | ———— | ———— | +++— | ++—— |
| | 0.1 per cent. | ———— | ———— | ++++ | +++— |
| | 0.02 per cent. | ++—— | ++—— | ++++ | ++++ |
| | 0.01 per cent. | +++— | +++— | ++++ | ++++ |
| Lactic Acid | 2 per cent. | ———— | ———— | +——— | ———— |
| | 1 per cent. | ++—— | ———— | ++++ | ———— |
| | 0.2 per cent. | +++— | ———— | ++++ | ———— |
| | 0.1 per cent. | ++++ | +——— | ++++ | +——— |
| | 0.02 per cent. | ++++ | +——— | ++++ | ++—— |
| | 0.01 per cent. | ++++ | ++—— | ++++ | +++— |
| | 0.005 per cent. | ++++ | +++— | ++++ | ++++ |

| | Dilution | Normal Saline Solution | | 1 per cent. Peptone Saline Solution | |
|---|---|---|---|---|---|
| | | 1 min. | 5 min. | 1 min. | 5 min. |
| Merfenil | 0.2 per cent. | — — — — | — — — — | — — — — | — — — — |
| 1 per cent. | 0.1 per cent. | — — — — | — — — — | + + — — | — — — — |
| M & B | 0.02 per cent. | — — — — | — — — — | + + — — | — — — — |
| | 0.01 per cent. | — — — — | — — — — | + + — — | — — — — |
| | 0.001 per cent. | + — — — | — — — — | + + + — | — — — — |
| | 1 : 1 mil. | + + — — | — — — — | + + + — | + — — — |
| Iodine | 1 per cent. | — — — — | — — — — | — — — — | — — — — |
| | 0.1 per cent. | — — — — | — — — — | — — — — | — — — — |
| | 0.02 per cent. | — — — — | — — — — | — — — — | — — — — |
| | 0.01 per cent. | — — — — | — — — — | + + — — | + — — — |
| | 0.001 per cent. | — — — — | — — — — | + + + — | + + — — |
| | 1 : 1 mil. | + + — — | + — — — | + + + + | + + + + |
| | 1 : 10 mil. | + + — — | + — — — | + + + + | + + + + |

In the presence of 1 per cent. peptone the results obtained in the above tests suggest :

(1) That the dyes in the higher dilutions are not effective.

(2) That lactic acid in the weaker dilutions is not effective at one minute.

(3) The higher dilutions of iodine and Merfenil give effective results.

The results of the iodine test are of interest in that iodine solutions as a uterine injection in cows are still the most efficacious treatment. The test results suggest the use of a 1/5,000 solution of iodine as an effective urethral irrigant.

The experience gained in Northern Ireland by the use of dyes in the treatment of affected bulls has not been attended by the success claimed by others. In the case of bull "A" brilliant green was applied twice under epidural anæsthesia, 0.1 per cent. for washing the preputial sheath and the penis and 0.01 per cent. for irrigation of the urethra without success.

**Summary**

The symptoms and lesions of trichomonad infection of bulls in Northern Ireland are described. Included is a discussion of the problems of control and treatment. The effects of certain chemicals on *Trichomonas fœtus* in vitro are recorded.

**Acknowledgments**

The author during these investigations received valuable assistance from his colleagues, in particular, Dr. H. G. Lamont, of the Ministry of Agriculture. His thanks are due to Dr. R. Lovell for examination of sera against Corynebacterium, and to Dr. McMurray for his interest in the histological sections. In addition his thanks are due to the many practitioners for the material supplied and assistance rendered.

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## THOROUGHBRED INHERITANCE AND MATHEMATICS

By THE BARONESS WENTWORTH

HORSE breeding for racing is a gamble against odds. Breeding livestock on a mathematical calculation, whether based on Veuillier's dosage or J. B. Robertson's dogmatic statements or Bruce Lowe's numerals or the study of test-tubes and germ plasms, still continues to follow an unpredictable course of glorious uncertainty. Mathematics applied to horse breeding are about as reliable as an "infallible" betting system, likewise based on what appear on paper to be incontrovertible figures irresistible to mathematicians and fascinating to gamblers, yet proverbially liable, when applied in practice, to end in the bankruptcy court. In fact they are even less reliable on account of the *ad infinitum* multiplication of unknown and unstable elements, individual conformation, temperament and racing luck, not to speak of possible stud-book and other errors, even printers' errors! Figures cannot lie, but, like the camera, they can and do prevaricate alarmingly. Reducing them to order in the animal world is an Alice-in-Wonderland game of croquet. As soon as you have got the flamingo's head straightened out, the hedgehog has run away!

The latest law of inheritance advanced for our consideration would, if correct, revolutionise the whole system of modern breeding from winners which has given us such star performers as Hyperion, Sun Chariot, Big Game and all our various magnificent breeds of cattle and put us at the head of the world's livestock breeders. The newest law is laid down as follows: "Neither the sire nor the dam can convey *any* characteristics to their progeny and the progeny inherits *all* the characteristics from its four grandparents." Whatever the scientific data on which this rather startling statement is based, the inexorable fact remains that it is most positively not confirmed in practical breeding, and I venture to think that few racehorse breeders would care to risk their money on its actual application by mating his mares to non-winners, however brilliantly bred from winning stock. In fact one of the latest exponents of the theory says: "There is a great probability that a good winner will be bred by mating a successful sire with a mare that has shown racing ability," which is, of course, no news to breeders and appears to them a mere restatement of the obvious.

Let us examine some facts, first taking colour as a "characteristic." It is a known fact that in the matter of colour two chestnuts cannot and do not ever breed anything but a chestnut, however many other colours there may be in the ancestry. It is also a fact that two bay parents can occasionally produce a chestnut, but should this chestnut be mated to another chestnut also bred from two bays it will never produce anything but chestnut progeny though all its four grandparents are bay. Again, though grey horses often breed coloured stock no grey horse can be bred unless one of the *parents* is a grey, the coloured produce of greys bred together will never produce grey; on the contrary, the grey grandparents exercise no influence whatever in the matter any more than the bay grandparents do in the case of chestnuts. This law of grey inheritance makes it all the more extraordinary that the grey colour of the Alcock Arabian should have been transmitted down 24 to 26 generations for 240 years, although one parent on one side or other has often been bay, brown or chestnut, in some cases 23 times out of 24. Take full sisters like Tiffin (bay) and Tetrapylon (grey), both

by Tetratema (grey), out of Dawn Wind (bay). Tiffin could never have bred a grey unless mated to a grey, whereas Tetrapylon could produce grey whatever the colour to which she was mated.

Curiously enough we never get an " interrupted " throw-back to a remote ancestor, even as a freak. The law seems absolute, and where records might appear to contradict this, there is an emphatic presumption of inaccuracy.

The records of colour in the G.S.B., which is the record most likely to be consulted, cannot be relied on for scientific conclusions. The editors are naturally dependent on the accuracy of the annual information supplied as to foals by the breeders or their grooms, and these are sometimes unreliable and premature, especially in the case of greys. Foals are often registered as black, brown, bay, roan or even dun. Some mares, now white, still appear in the G.S.B. as bay. One arab horse now white is still down as dun and this is probably what happened in the case of the Oxford dun Arabian, as dun is a Scandinavian not an Arab or a thoroughbred colour. Greys are often foaled black or brown and pass through transition stages like cygnets, some of which are almost invariably mistaken for roan or dun. The very dark legs of a foal which is going to turn grey are most misleading, and the whole-black or brown colour may persist for a couple of years and requires an expert to discover the few grey hairs. Chestnut foals turn grey quicker than black ones. If one parent is grey there is always a likelihood of a very dark coloured foal becoming grey. Since the advent of the Tetrarch strain people have become a little more cautious and in registering brown sometimes add " or grey."

We can prove the same non-inheritance from grandparents in the human race. Parents both brown-eyed can transmit blue or grey eyes, but blue-eyed parents do not transmit brown, and blue or grey-eyed parents (both bred from brown-eyed parents) will, when bred to each other, not transmit brown, nor will their children do so. Here again the influence of grandparents is nil. As in horses, should any divergent case appear there is strong evidence of illegitimacy or other error.

It is quite evident that the results of livestock breeding can never be reduced to a mathematical certainty. If we admit the principle of heredity at all we have to contend with the conflicting elements of 134,217,726 units in a pedigree of 26 generations, not to speak of the unrecorded elements which extend behind them, as I have said, *ad infinitum*. What mathematician could venture to predict results on such a formidable calculation? It just cannot be done.

It is evident that the influence of immediate ancestors is all we really have within the scope of application to practical mating and we must be content with this. After all, we have not done so badly and I strongly recommend adhering to it. The only ancestry we can count on not to fail us as a general principle is pure blood inbred to itself. Like breeds like. Reversions to past individuals will, of course, occur, but no one can possibly tell when this reversion will appear or what causes it. Some reversions never occur. The purer the blood the less uncertain are the results. There are certain characters which have been fixed by intensive inbreeding which are immediately lost by any attempt at outcrossing, as in the Orloff trotters, inbred to supersaturation with father, daughter, brother, sister and mother.*

* See *Thoroughbred Racing Stock*, by Lady Wentworth.

Whenever this was changed the horses deteriorated immediately. It is noticeable that the original blood being good they developed no unsoundness of limb or constitution.

The law of inbreeding is inbreed good and you get better, inbreed bad and you get worse. If there is a latent defect it is almost bound to come out. Latent virtues should do the same, but progression is always less easy than retrogression.

If all the rules of mathematics set out for breeders apply, how do we account for certain sires which appear to produce winners from practically whatever mare may be mated to them? All these fractions immediately lose their application, the potency for speed obviously lies in the immediate sire, regardless of the dam's lineage and not in the four grandparents. The same applies to mares. Some show-ring mares are so good that they get show-stock, however inferior the sire, and some sires are so prepotent that they stamp their conformation on every foal.

In Arabs it is much easier to follow the laws of inheritance, as the blood is so pure that results are immediately apparent and can be predicted with considerable certainty and in their case I find it best (given a clean pedigree) to breed on conformation only. The good qualities of endurance and other performance follow automatically. I also find that, in order to produce weight carriers and long-distance winners, great measurement below the knee is not necessary. By weight I mean up to 18 stone, and by distance any race up to 310 miles. So long as the tendons are large and straight and detached, and taut like violoncello strings to the touch, the "bone" can be disregarded, and here almost all remount breeders and Government officials miss many a good sire by insisting on big bone and limiting their choice by colour prejudices.

I speak from experience, as horses and mares from this stud hold the world's record against all breeds for distance, speed over a distance, soundness, weight carried, and small amount of feed consumed during the races. I have always bred without racecourse or other tests, but the same good results have been achieved all over the world and the prize-ring winners have also proved the best performers wherever the combination has been tried.

My respect for conformation, balance, symmetry and quality is, therefore, greater than that expressed by some modern writers. It is true that we see T.B. winners in all shapes, many weedy and unpleasing, but they are very seldom good *sires*. Derby winners are mostly extremely symmetrical and where they are not so they very soon drop out as sires. Take Bend Or, Cicero, Hyperion, Cyllene, the Tetrarch, Tetratema, Fair Trial. No more perfectly made horses could be desired. The comparative non-success of the beautiful Coronach's stock was not due to lack of *ability* to race (they could race all right at home), but to a defect in racing temperament which was impatient of dictation and nervous of crowds. Papyrus, a horse of ponyish build, lacking scope, was not a successful sire; and I could name other Derby winners of awkward and ugly shape which have not and are never likely to make good at stud: they may get a sporadic winner but are inferior sires.

The Grand National is the severest test of stamina which we now have in England, and it is certainly a formidable one, four miles over 30 of the most

terrific fences in the world and run at breakneck speed. That we still breed a horse which can do this and continue steeplechasing for years shows that there is nothing really wrong with our stock, but the premature gelding of steeplechasers makes the test useless to breeders and it would be well if geldings were barred from competition in the Grand National just as they are barred from the Derby. In this way we could breed from our proved stayers and our soundest, most enduring stock, instead of letting it run to waste.

In the human race outstanding aptitudes often come from families distinguished in a similar way, but this may be due to upbringing and early training, and we do find many instances when no aptitude is inherited either immediately or remotely. We also find all of a sudden a remarkable genius, mental or physical, springing up out of nothing at all, defying every opposing circumstance against its development with no history whatever of similar talent behind it, yet in spite of every effort of training and environment and money spent on trying to reproduce it again in the man's descendants, his genius generally dies with him. In fact very often his descendants are adversely affected by their efforts to live up to a standard entirely beyond their capacities and may even fall below the average.

To sum up, figures are fixed units, livestock variable units. Even the apparently simple two added to another two in animals bred the same way, and which should, theoretically, be exact duplicates, cannot be relied on to make the expected four. Two and two do *not* always make four, but diverge irresponsibly into making all sorts of odd numbers. So all hard and fast rules and calculations must go by the board, and we return to the gamble we set out from.

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## FOOD AND POISON GAS—III

By Dr. JOSEPH DOWGIALLO

### PART V

PROTECTION AND SECURITY OF FOOD AGAINST CONTAMINATION

**General Remarks**

THIS is probably the most important question in connection with foodstuffs. It is easy to carry out in a large majority of cases. For quite small quantities of food, many different materials or protective objects can be used. The perfect materials for protection are *glass* and *metal* containers, such as sealed metal drums, boxes and tins, glass jars, glazed earthenware vessels and bottles with properly fitting stoppers. *Tinfoil* and *silver paper,* which protects tea, chocolate or cigarettes, are also very good if the contents are well packed. It should be noted that some metals will corrode in the presence of moisture and they should never be exposed to wet of any description. *Wood* is also a good protection, especially sealed wooden barrels and boxes with all joints absolutely tight. All woods are not equally gas-resisting. It depends largely upon the wood fibres. Blister gas can penetrate wood to a depth of about 0.5 cm., especially if the wood is soft, and, if not decontaminated, can penetrate deeper and become a further source of contamination. Hard woods, such as oak, teak and plywood, are the best. Resinous or damp wood absorb less blister gas than non-resinous or dry wood. The grain of the wood should be noted—vertical can be contaminated easier and deeper than horizontal. The surface is also important. A polished or even surface is far

better protection than a dull, unfinished one. *Wax paint,* and especially *varnish,* are also quite effective. *Glazed earthenware* vessels or *celluloid* boxes or *bakelite,* and even *waterproof cellophane* properly sealed, are quite good. *Bitumen* is good if kept dry. *Textiles,* such as wool, cotton, sacking, canvas bags, etc., give very little protection, especially from liquid blister gas, because it soaks into the fabric and adheres to it. Smoke and volatile gases will adhere to the surface and thus contaminate the contents. *Impregnated material,* such as tarpaulin, is good protection against poison gas but it is not foolproof with blister gas. It should be noted that oil impregnation (not varnish) of the material is rather dangerous, because the oil will absorb the poison and retain it for some considerable time, thereby causing further contamination. *Rubber* is not a good protective covering against liquid blister gas, which can penetrate in a short time (about half-hour), but is fairly good against other gases. Specially treated anti-gas rubber is, of course, very good. *Leather* can protect against non-persistent and the vapour of blister gas, but is no use against liquid blister gas, which can penetrate in from 15-30 minutes. *Waxed cartons, cellophane paper* and *greaseproof paper* are all good protection for non-persistent gases and the vapour of blister and smoke gases if they are kept dry. Non-impregnated paper is no protection.

Large quantities of food stored in grain elevators, refrigerators, etc., are protected mainly by the security of their fastenings (doors and windows gas-proof, etc.) and are separately dealt with for each particular case.

The protection of large buildings, such as stores, factories, slaughterhouses, etc., must be more fully dealt with. The degree to which the buildings are gas-proof bears greatly upon the danger of contamination.

It is necessary to have a specially trained service as follows: *Decontamination, rescue* and *spotting squads.*

Their task will be: (a) to be on the look-out for gas-bombs; (b) decontaminate immediately all dangerous places, craters, shell-holes, etc.; (c) close all food containers before contamination and open them after the danger is past; (d) make a preliminary valuation and, if necessary, remove the contaminated food; (e) decontaminate when possible and destroy articles of food which are heavily contaminated; (f) bring immediate relief to persons or animals who have been poisoned.

To revert to food protection, there are several points worth mentioning in this connection. The refrigerator provides perfect protection and the only precaution necessary is to make sure that all doors, windows and ventilators are securely fastened. In the case of grain elevators, it may not be possible to make them absolutely gas-proof but, fortunately, the contamination will be only superficial—not usually more than 3-5 cm., seldom more than 10 cm. It is more difficult to protect haystacks and hayricks; liquid gas will penetrate to a depth of 10-15 cm. (seldom more than 20 cm.).

Cans of food, if efficiently sealed, cannot be contaminated.

*Protection of fields and pastures is impossible.* Rapid decontamination is difficult. If left for the correct length of time they will decontaminate themselves. The weather is also a good aid. Rain, wind and sun cause destruction of poison gas by evaporation or hydrolisation. Rain decomposes the poison compounds.

*Earth* is a good protective material for many products.

Root vegetables can be protected by a layer of earth 10-20 cm. deep.

*Water* contaminated by poison gas has usually an objectionable smell and will taste salty, acid or bitter, depending on the gas used. Decontamination of water is carried out by boiling for not less than 1-2 hours. Water will also hydrolise some gases, e.g., chlorine, phosgene and partially mustard gas (0.7 per cent.). Small quantities of water contaminated by mustard gas can be filtered by a simple method, i.e., in a pail with a perforated botton put gauze folded 5-10 times, a layer of sand 10-20 cm. deep and over this another layer of gauze folded 5-10 times, and run the water through this into another receptacle. After this filtration, the water must be boiled. If there are spots of blister gas on the surface of the water these can be removed before filtering. Decontamination of water contaminated by arsenical gases is never certain and should always be done by an expert. In chemical decontamination of water it is intended to neutralise the poison, but the remnants of the chemical will often leave a bad taste. Although such water is not dangerous, it is best used for purposes other than drinking.

*Protection of pond water is impossible.* Pond water is difficult to contaminate because a great deal of poison is necessary and liquid poison tends to fall to the bottom and is destroyed by hydrolisation or absorption into the weeds. However, certain parts of the pond may be dangerous, because the wind and waves will carry the poison to the edges, where it may remain for several days among the weeds, etc. The rapidity of decontamination depends on the type and quantity of poison, weather and presence of weeds, plants or mineral salts in the water. The danger becomes evident if the water is used for washing or when it is used for bathing and accidentally swallowed.

*Running water* cannot be protected but it is very difficult to contaminate, because the current will carry the poison with it and quickly disperses and destroys it. The poison may be carried to the edges, where it will remain among the weeds, and care must be taken to note any oily spots, unusual smells, etc. If the place is known to be contaminated, the water should be used 20-50 feet above the area.

*Open wells* are very dangerous when contaminated and it is almost impossible to decontaminate them within a reasonable time. Even if this is done, there will always be an unusual smell or an objectionable taste. Decontamination takes from one to three months or more. It is not prudent to use such wells for several months and even afterwards it is necessary to examine the water expertly, especially if gases in Group IV (arsenical, and compounds of heavy metals and phosphorous) are suspected.

The quickest method of decontamination is to drain the well, refill and examine the water again, but very often the poisonous sediment is left. To avoid the possibility of contamination in a well it should be fitted with a wooden cover, topped with felt and padlocked.

*Artesian and Abyssinian wells,* etc., are usually sufficiently well protected. For absolute protection the openings can be stopped up with cork and the ground around raised to a higher level with sand. The contamination of water in *aqueducts* is not easy, and is more likely to be of a bacteriological nature than a chemical one.

## PART VI

### Clinical Diagnosis and Anatomo-Pathological Symptoms of Poisoning in the Digestive Organs

#### General Remarks

The delicate mucous membrane of the digestive tract is moist and possesses numerous secretory glands, free sensory nerve endings and superficial blood capillaries; consequently, the tissues absorb poisons easily and react very quickly to them.

Poison gas, after reaching the digestive tract, causes not only immediate signs of illness in the digestive organs but it can act indirectly on other organs, e.g., compounds of heavy metals, and especially phosphorus, act indirectly on the parenchymatous organs, kidneys, liver, heart and spleen, and often cause very rapid changes, fatty degeneration, etc. When these poisons circulate through the bloodstream they cause a general organic disturbance. The changes are characteristic of each particular poison and are easy to identify.

Group I.—(a) *Choking gases.* The clinical symptoms are represented as general disturbance, listlessness, loss of appetite, colicy pains in the region of the stomach, thirst, sometimes vomiting, general debility and inertia. The poison sometimes acts simultaneously on the respiratory organs and causes attacks of coughing and other functional disturbances.

(b) Poisoning by so-called "*common action*" gases, such as hydrocyanide (HCN) and carbon monoxide (CO), are very rare and their use is doubtful, and, in the open air, impossible, because of their high volatility. After consuming food poisoned by HCN the following general symptoms will appear: visible irritation of mucous membrane, vomiting, respiratory disturbances, heavy breathing, convulsions, cramp or tetanus, enlargement of the pupils, loss of consciousness and, in heavy cases, death usually within one hour.

Group II.—*Tear gases and chloropicrin* evoke strong sensory nervous irritation. The action, in consequence, is somewhat similar to that of the choking gases in Group I. Important signs of poisoning in the digestive tract are irritation of the senstive nerve endings, sometimes violent vomiting, congestion of the mucous membranes and copious salivation.

It should be noted that chloropicrin, even after decomposing in the food, will cause symptoms of general disturbance. Even when the presence of the gas in the food does not cause symptoms, this does not mean that there will be no harm done to the organs. Pathological changes resulting from poisoning by Group II gases are similar to those of Group I, but they are present in a greater degree (congestion of the mouth and œdema of the mucous membranes, catarrh of the stomach and other parts of the digestive tract). Contamination by chloropicrin gas gives rise to characteristic brownish stains of the mucous membranes of the stomach caused by combination with the hæmoglobin in the blood.

Poisoning by smoke gases causes the following symptoms: salivation, restlessness, vomiting, lack of appetite, painful colic, constipation, sometimes diarrhœa, irritation or nervous symptoms, trembling, faintness, sometimes attacks of fury, transitory paralysis or epilepsy.

GROUP III.—*Mustard gas* has a burning or blistering action and is also a poison of the vascular system. There may be no clinical signs in the first few hours but eventually there will be vomiting. Next day there will be listlessness, colicy pains, congestion and great pain in the stomach, rigor of the head and neck and coma. Ulcerated spots in the mouth and necrosis of the mucous membranes may also be present. Anatomo-pathological changes are: swelling, congestion, subsequent inflammation of the mucous membranes of the mouth, tongue, and other parts of the digestive tract; hæmorrhagic inflammation of the stomach and intestines, necrosis and ulceration represented by large or small spots and spreading of the swelling.

GROUP IV contains compounds of arsenic headed by *Lewisite; compounds of heavy metals,* lead, tin, etc., and phosphorus. All these compounds are extremely dangerous and they persist for a long time, and even if broken up their residue remains poisonous (arsenic).

Clinical symptoms of poisoning through the digestive tract are: depression, active disturbance, serious external injury as from mustard gas and also the presence of the arsenic. It is well known that 100-150 mg. of arsenic will cause death; 0.1 gms. will kill living organisms within a few hours. Besides the usual symptoms of depression, there will be colicy pain, sometimes coughing, violent vomiting, swelling of the mucous membranes and congestion with lividness, restlessness, panting, rapid heart action, nervous and physical disturbance, general debility, fainting, loss of sense of balance, and, afterwards, extreme weakness, coma and death.

Lewisite is a strong poison both in its initial blistering actions and later effects caused by the poisonous arsenical residue. After absorption into the bloodstream it causes changes in the liver, spleen and kidneys.

The action of Lewisite is rapid, much more rapid than mustard gas, and causes more serious injuries to the tissues.

The general symptoms produced are like those of mustard gas but with deeper tissue action, not only in the mucous membranes but also in the underlying tissues. (*Note.*—A drop of mustard gas can penetrate the human skin entirely within 20 minutes, whereas Lewisite will only take about five minutes.)

Fatal doses by the digestive tract are less than by the skin.

The blisters after eating contaminated food are extremely painful and the symptoms appear very quickly.

Lewisite poisoning causes deep ulceration and necrosis of the tissues of the digestive organs. There may be serious inflammation of the mucous membranes and underlying tissues, and purulent inflammation extending to the deeper layers, with a tendency to bleed.

Pathological changes are: inflammation of the stomach and intestines, and dark red colour or grey spots, especially in the large intestines. There may be a residue of heavy metals in the food content of the stomach.

After arsenical poisoning, at post-mortem the mucous membranes of the stomach are covered with mucus and there is a distinct smell of garlic. In

phosphorus poisoning the mucous membrane of the stomach is covered with adherent mucus, which is very difficult to separate.

After poisoning by any of the gases in this group (compounds of arsenic and phosphorus and heavy metals) fatty degeneration is marked. This is particularly apparent with phosphorus. It appears very quickly, sometimes only a few hours after poisoning.

The symptoms of poisoning after eating contaminated food depend upon the type and quantity of poison used, which may act directly at the site of contamination or indirectly on certain organs or on the system in general. Choking gases, after immediate action upon the digestive tract, attack the respiratory organs. Chloropicrin acts upon the plasma of the cells. Carbon monoxide (CO) poisons the blood by combining with hæmoglobin. Hydrocyanide (HCN) acts upon the blood and central nervous system and on the respiratory or vasomotor centres.

Mustard gas poisons the blood vessels and also the plasma cells.

Phosphorus and heavy metal compounds act upon the parenchromatous organs.

**First Aid Treatment**

The following indications can serve as a base for first-aid in cases of poisoning by the digestive tract:

(1) Removal and immediate destruction of the remainder of the contaminated food.

(2) Thorough cleaning of the mouth and rinsing with a weak solution of bicarbonate of soda—soda 1-2 per cent.

(3) Use, if possible, of the stomach pump or the giving of an emetic. The latter should only be given if the patient is in a good state of health and the heart is strong.

(4) Plenty of water should be given with a solution of sodium carbonate (0.5-1 per cent.). For poisoning by arsenical compounds magnesia will be beneficial.

(5) The patient must have plenty of rest and quiet, and a sedative should be given if necessary. In the latter case morphine or chloral hydrate are contra-indicated when dealing with choking gases. Treatment will depend on the severity of the poisoning and great care must be taken (a) to regulate the digestive organs by a non-irritant mild purgative, such as sodium sulphate, (b) to regulate the heart action with camphor oil, caffein, valerian and sometimes morphine.

(3) See that the patient is kept warm.

Poisoning by carbon monoxide and hydrocyanide can be treated by oxygen inhalation, with $CO_2$, the stomach pump and warm covering. To regulate the heart, lobelin, caffein or camphor should be given. Treatment must be immediate and direct.

Further treatment will depend upon the symptoms. Sometimes the results of first-aid treatment will be poor, for, although the immediate symptoms may be relieved, secondary changes may occur in essential organs.

## FEEDING THE BACK-YARD PIG

By GRAHAME WILLIAMSON

DIFFICULTY arises as soon as one starts to discuss in general the feeding of the householder's pig, in that the existence of a small isolated unit depends upon a supply of food the nature of which one can only surmise. One may be right in supposing that, as the designation indicates, the basis of the food is to be household scraps. Not all back-yard pigs, however, are maintained on food from such a source; many are kept to consume waste or surplus garden products, while the owners of others may have been tempted to acquire their stock because of an easily obtained by-product such as may be available at a local knackery, brewery or fishing centre, and so it is that the feeding of the back-yard pig may present a problem the nature of which in one locality may be quite different from that in another. There are, however, certain broad principles which apply under all circumstances and which must always be kept in mind if satisfactory results are to be obtained.

Many householders are prepared to start feeding any healthy looking young pig quite irrespective of its suitability from the point of view of its breed or, what is perhaps more important, its history, and so they may handicap their enterprise right at the onset.

Within recent years, both officially and unofficially, much effort has been expended to induce pig owners of this country to concentrate their attention on a few selected breeds, so that the bacon industry might be helped to produce a standard article such as consumers of to-day demand. The breeds which answer that purpose best are those whose individuals develop a high proportion of loin to head, a thick belly muscle and a good ham, that is, a low proportion of bone, a high proportion of muscle and a limited amount of fat. Having due regard to these essentials, the breeder naturally favours the more prolific breeds—those which will farrow regularly and nurse their litters well, while the feeder tries to obtain the strain of pigs which give the biggest return of high-class bacon for a given amount of the very high class food available to him.

If the back-yard feeder can fatten his pig under the more or less standard conditions which used to prevail in the industry before the war, on similar food and with the same end in view, he will find no better breeds of pigs to answer his purpose than those whose use has been so strongly advocated, such, for instance, as the Large White. If it is taken for granted, however, that both the conditions under which the pig must live and the food which it is kept to eat vary very much indeed from those to which the trade was accustomed, and further, that quantity of carcase rather than quality is now the more important consideration, then it is probable that breeds other than those so generally used may be the most profitable for him to keep. It was diversity of local conditions, customs and needs which accounted for the evolution of such a great variety of breeds in Britain; each answered a local want in the days when the characteristics of one district differed so materially from that of another. The requirements now are not the same as they used to be but the diversity of conditions has again arisen, at any rate as far as the household pig is concerned. If a breed has lingered on in a district and is still used by the cottagers of that locality it is

probably correct to assume that it has done so because it thrives better there than pigs of other breeds would. It is a recognised fact that in many parts of the country the call to use one of the officially sponsored breeds was never fully answered, simply because the inhabitants found by experience that perhaps a short, thick pig, maybe a cross-bred one, stood up to the hard conditions of food, housing and management better than the high-grade, well-bred animal does.

The point that is being laboured is this, that pigs evolved for our pre-war requirements are not necessarily those which are best suited for the back-yard.

As regards the other consideration, that is, the history of the store pig, it may be said that if the return for feeding is to be fairly certain of achievement and reasonably quickly obtained, it is essential that the store pig is not introduced into conditions which are inferior to those to which it has been accustomed. The younger the store, the more important does this provision become. Take, for examples, the case of an eight weeks old pig bought direct from a breeder who has reared it under intensive, that is, forcing, conditions. Up to the time of receipt it has probably been fed on its dam's milk supplemented by a high-grade meal. If the householder is able to continue the supply of meal and to give milk with it, the young pig may overcome the difficulty associated with a change of surroundings, the loss of the dam and the change of management, without undergoing any serious check, but should that high quality of food not be forthcoming —and what householder in these days can spare milk each day for his pig?—then one must expect at best a stagnation in body weight gain and and a lowering of resistance to disease.

It is for that reason that it is well for the back-yard pig to have seen something of life before it is introduced to the sty. The survivor of a course of hardening off at the breeder's or even at the dealer's is sure to respond more quickly and take to his new surroundings more readily than a young pig which has been kept on a high plane of nutrition. One realises, of course, that that sort of pig is the one which in normal times would rightly be avoided, because such treatment results in an overfat carcase of not the best quality, but the present-day needs of the householder are not exactly what they were; fat is more acceptable than it used to be and if in producing it pig feeding is made easier, there are few who will look on it with disapproval. As every veterinary surgeon knows, there is all the difference between a lean, healthy, active young pig and a bad doer which has failed to develop; the one will pay for his keep, while the other will prove less profitable than a compost heap. Unfortunately a certain amount of skill may be involved in making the necessary discrimination and to ensure that no mistake is made, the less experienced pig feeder should buy his store direct from a reputable breeder who favours free range or, at least, out-of-door rearing, and in any event he should avoid buying a pig of unknown origin in the open market.

Taking all things into consideration, the householder will be well advised to buy an animal of some 70-75 lb. weight, because at that age it can deal more adequately with coarser food than a younger one could, besides it has long overgrown any post-weaning check and has passed the stage at which pigs are most liable to fall to one or other of the common pig diseases.

The next point of importance in feeding the pig, and one which is far too often overlooked, is the necessity of adequate housing. The average householder has no conception of the large part good housing plays in the success of feeding, and thus in the economy of pig keeping. Nothing elaborate is required; provision just for dryness, warmth and fresh air. The owner must get out of his mind that any place which is strong enough to retain a pig, no matter how dark, damp and vile it is, is good enough. He will best understand that as soon as he comes to realise what such conditions cost him in the matter of food alone, and food is conceded to represent 70-80 per cent. of the cost of producing a pig. The amount used to counteract unfavourable environment is very high and may amount to as much as three-fourths of the intake, so that in good conditions the pig may gain a pound in weight for every 2½ lb. of food eaten, while under bad conditions 8 lb. may be needed. Most of the loss is accounted for in the necessary production of extra heat, some of it represents the price exacted by maintenance on a low plane of health, and the rest is lost by even less obvious routes. Let the householder compute what these unnecessary expenditures cost him in hard cash and avoidable trouble, and no more need be said on that score.

We know too well how dampness, filth and bad ventilation is responsible for a potentially valuable meat carcase being in fact fit only for manure through the intervention of disease, but it is often forgotten that even if disease is avoided, these conditions have an adverse effect upon carcase quality, which, although it may be of small significance in comparison to total condemnation of the carcase, is still of importance. If we call to mind that experiment undertaken by Kellner so many years ago, it serves to emphasise the point that a warm sty favours the production of firm bacon. Taking three young pigs of the same breed, one of them was kept in a high atmospheric temperature while the other two were kept in a temperature around freezing point. One of these pigs, however, was sewn up in a sheepskin to keep it warm. The three pigs were fed in exactly the same way and, on slaughter, after two months, it was found that the unfortunate which had been unprotected from the cold had a body fat of much softer consistency than the others.

The directions regarding sty construction given in Advisory Leaflet No. 4 of the Small Pig Keepers' Council* on "Housing the Pig" are admirably practicable, the plans are easily followed and the specifications illustrate how to economise in material.

The only rational way for the cottager or householder to feed his pig is by the system now associated with the name of Lehmann. The Lehmann system of pig feeding has got much publicity in recent times and until one is *au fait* with the practical details of its application one is likely to consider that it entails a radical alteration in our established practice. It does, in truth, entail such an alteration if by the term "established practice" we mean the system by which the pig population of this country was harnessed to the large pre-war cereal importing firms so that for the great majority of the animals wheat by-products and cereals were the main source of food, the complement of which was generally fish meal. If, on the other hand, we go back to the time when pigs were kept on the surplus of local produce or on the waste from the farmyard or household, just as are those we are now considering, it will be found that the system followed then, a

*The address is: The Barn, Turnville Heath, Henley-on-Thames.

system probably blindly arrived at as the outcome of successful experience, is essentially the same as that to which Lehmann has led us back through a process of rational thought based upon accurate experimental results. It will be remembered that he advocated a basal ration of a concentrated nature, the amount of which increases with the growth of the pig and its appetite to about 2¼ lb. and is there fixed; the further growth of appetite is then met by giving as much food of a more bulky kind as the animal will eat in addition to the concentrate.

If the back-yarder can be profitably maintained, there must be sufficient food, such as garbage or kitchen waste, garden produce in the shape of potatoes, roots or green vegetables, etc., to meet the appetite of a large pig, e.g., up to 230 lb. Allowing 23 weeks in which to produce a body weight gain of 160 lb. it will be found that over a ton of potatoes or other such food is required. At first the amount eaten is a little over a pound per day, but that increases until 16 to 20 lb. are consumed. With that as his stand-by, and without it no attempt should be made to fatten a pig, his main difficulty will be in acquiring the concentrated or basal part of the ration.

It has been shown that, taking the whole course of fattening into consideration, something less than 2¼ lb. per day will suffice, not perhaps at first when the pig is laying down new body tissue and has as yet not developed the power of dealing with coarse foods, but on the average daily need throughout its life. In the last few weeks very little meal, indeed, may be required. It will be sufficient then if a supply of 2 lb. per day is arranged for. In pigs of about 50 lb. body-weight it is important that the full amount of meal should be available, while at the same time none of the "standard" food will for a while be consumed. This is another reason why the back-yarder should not be bought until he has reached a greater weight.

It is contended that if the pig is to be fattened on household waste, and if the household waste is of good feeding value, that is, that it contains a fair amount of meat scraps, stale bread, and cooking waste of a similar nature, such food is good enough for even the newly-weaned pig. That cannot be denied, but we submit that a householder having such waste to discard in these days needs no advice on how to feed pigs, but rather on how to feed humans.

The concentrate should contain about 70 per cent. of food of the nature of cereals and 30 per cent. of a protein-rich material. The members of a pig club or individuals who have registered as keepers are allowed ½ cwt. of cereal meal and 7 lb. of protein supplement per pig each month, but over and above that there is still a fair amount of material which can be obtained without coupons and which when properly mixed makes satisfactory food. Some of these are:

Oat and barley dust.
Damaged or salvaged grain.
Cereal screenings.
Bakers' waste.
Brewers' wet grains.
Yeast.
Fish waste.
Condemned meat and slaughter-house offal.
Lucerne, grass, clover, etc., meal.
Seaweed meal.

Before trying to compound a diet from these ingredients there are some points in connection with them which it is as well to consider.

The cereal "dusts," for instance, are now commonly mixed with the ground husk and sold as oat, etc., "feed." In spite of the confidence which the change

of designation is calculated to produce, these products, in fact, contain far more fibre than the plain dust, and, although they serve certain useful purposes, their feeding value for pigs is, without doubt, reduced. Scree dust, and medium and fine barley dust, approximate wheat middlings sufficiently closely to allow of its partial substitution by these materials, especially as regards the first two, if the rest of the diet is of a pasty nature and needs opening out. On the whole, such material as oat husk meal is too fibrous for use in pig foods.

As regards damaged or salvaged grain, it is only consignments whose feeding value is questionable that will be available, coupon free. It need hardly be said that grain which has been grossly affected with moulds—probably the most common defect—may possibly, but by no means necessarily, be harmful to pigs; or it may be so unpalatable that it has a detrimental effect when added to other feeding stuff. Neither of these contingencies can be ascertained by casual inspection, but, if there is doubt, boiling, steaming and aeration will do a lot to remove the risk. The best way to ascertain its suitability or otherwise as a food is to let the pig decide. If it is offered in moderate amounts and accepted by the pig, its effect can be closely watched, and should indisposition follow, the feeding of it can be discontinued before the results become serious. The salt content of salvaged grain may be very high, but it would appear that our apprehension of salt poisoning in the pig has probably been unjustified and based upon misconception. Worden has recently drawn attention to this fact and, as he points out, pigs are not likely voluntarily to eat food containing a poisonous quantity of salt. They can apparently consume food containing as much as 5 per cent., but one-tenth of that amount is the allowance which is generally considered the correct proportion to have in the ration.

The only remark that need be made about cereal screenings is that the variety whose supply is not officially controlled is likely to be composed mostly of weed seeds with a small proportion of broken grain. The good-looking result of a chemical analysis should not mislead the purchaser, because many weed seeds are so small and hard that they escape mastication and pass through the bowel undigested. Nevertheless, provided there is no large amount of such deleterious seeds as corn cockle present, such screenings as may be had are well worth feeding.

Bakers' waste is excellent material for pig fattening and can substitute the cereals pound for pound. The waste contains relatively so little fibre that, if a fair proportion is used in the diet, it allows of a corresponding increase in the amount of other more fibrous foods.

Only a relatively small number of householders will be able to obtain and use wet brewers' grains. They are difficult to keep and, unless special provision is made, they must be fed while fresh. Calculated on a dry matter basis, the grains contain a little more protein than do middlings, but almost three times as much fibre, a fact which precludes their use for pigs below 80 lb. weight and limits the amount which may usefully be fed to pigs above that weight. The water content of wet grain is, by the time it is fed, about 67 per cent., and that accentuates their natural bulkiness. Nevertheless, the use of wet grains will save considerable quantities of the concentrates and, for that reason, they should not be unreservedly classified with the bulky foods.

As a source of protein the value of yeast is far too often overlooked. With

a digestible protein content of about 40 per cent. it ranks as one of the richest protein concentrates. It has, however, a bitter taste and so it may not be immediately acceptable even to a pig, but if it is introduced gradually to the diet the the animals quickly become accustomed to it and will accept quite large amounts. There is, however, no necessity to feed it in quantity and, in fact, because of its laxative nature alone, it is inadvisable to do so. Recently reports have been received of detrimental digestive effects resulting from the action of active, live yeast upon the other constituents of the diet, but factory dried yeast will not cause trouble in that way and even at the present market price far more use might well be made of it. It can with safety form up to 10 per cent. of the diet.

Fish waste may be obtained from fish shops, fish restaurants, etc., in the raw state in limited amounts, but yet sufficient for the requirements of small establishments. It is the fish gut, head and tails, skin and bones, with a small amount of adherent flesh. It is, in fact, the crude material of processed fish meal, but because of the large proportion of bone which it generally contains pig feeders fight shy of it. For the small daily requirement of the back-yarder, however, the material may be graded, after purchase, and the more bony parts removed. It is likely to contain not only the residue of white fish but also that of the less desirable kinds, such as herring and mackerel, whose flesh is strongly flavoured and contains much oil, so that it may cause taint and lower the quality of the carcase of the animal consuming it. That is an objection, but not an obstacle, to the use of ordinary fish waste in war time. It may be fed up to 10 per cent. in the early stages of fattening and to 5 per cent. later without much danger of producing taint, provided it is omitted from the ration during the last fortnight before slaughter. The raw material should be steamed or slowly boiled either in open receptacles or under pressure, until it can be easily mashed to a meal consistency.

All carcase offal, including blood, must by law be brought to boiling temperature for an hour before being used as food for animals. Apart from that provision the handling of the material is particularly difficult for the householder, and in the case of the most easily obtainable meat scrap, namely, sheep paunches and the emptied gut from knackeries, its use is generally quite impracticable unless it has already been treated before he acquires it. On the other hand, condemned flesh and fresh blood, although troublesome to prepare, can be dealt with in the small quantities needed. Blood should be heated either by boiling in a container placed in boiling water, or by the forcible injection of a jet of steam through it.

Of the vegetable protein concentrates, young grass, lucerne or clover meal is fairly easily obtained and, provided it is made from the plants in the young leafy stage, it will help to make up a satisfactory basal ration. It should, by analysis, show a protein content of not less than 20 per cent. and a fibre content of not more than that amount, any lower standard is not to be considered. Lawn clippings may generally be counted upon to reach this level, and a very useful supplement they make to the ordinary meal diet, but unless they have been dried and ground their bulk precludes their use in the basal ration. The drying should be done quickly and without undue exposure to sunlight if their value is not to be lowered. They are difficult to save, as they easily ferment and become unpalatable, and so unless unusual facilities exist they are best fed fresh

or nearly so, and must then rank midway between the coarse foods and the concentrates. Their value has been convincingly shown by Donald,* who used them successfully for fattening pigs to the extent of one-third of a ration with potatoes.

A certain amount of seaweed meal is available and can be used with advantage to augment the diet, but only to a limited degree, because it may contain as much as 20 per cent. of ash, the largest ingredients of which are the salts of sodium and potassium. In other respects it quite closely approximates the cereals. One per cent. of the total ration is the amount generally recommended and that is given not so much for its direct nutritive properties as for one or other of the useful minerals it contains in a readily available form.

To illustrate the use of these materials let us suppose that the back-yarder is primarily kept to eat household waste and that the owner is able to obtain scree dust or barley dust, bakers' waste, dried brewers' yeast, fish waste and clover, or young grass meal.

The pig is 80 lb. in weight and should have an appetite capacity of about 4 lb. of dry matter. Two of these pounds are to be composed of the cereal and protein concentrates and might be mixed in the following amounts for the food available:

Bakers' waste: 35 parts, or 11 ozs.
Scree dust, or medium or fine barley dust: 35 parts, or 11 ozs.
Fish waste (60 per cent. moisture): 15 parts, or 12½ ozs. (equals 5 ozs. of dry matter).
Yeast: 5 parts, or 1½ ozs.
Grass meal: 10 parts, or 3½ ozs.

The household swill should be steamed or boiled in a minimum quantity of water. The surplus water should be drained from it and offered in a separate receptacle as a soup; if the swill is not drained there is a danger that the amount of fluid may be great enough to limit seriously the dry matter intake of the pig. A certain amount of the boiled swill, an amount calculated to be well within the capacity of the pig, should be mixed and fed with the basal ration as two feeds, the first in the early morning and the second in the early afternoon; what remains of the swill should be offered later. By feeding three times a day increased consumption of the bulky food is encouraged.

As the pig gains in weight the amount of yeast might be increased to 3 ozs. and the clover meal to 5 ozs., with a proportionate decrease of the fish waste, but the total amount of basal mixture should remain fixed at 2 lb. If the swill is composed mostly of vegetable waste, as it probably would be in summer, then 2½ lb. of the basal ration should be given.

A mixture composed from other material might be:

Wheat screenings or damaged grain: 40 parts, or 12½ ozs.
Scree dust: 20 parts, or 6½ ozs.
Wet brewers' grains (70 per cent. moisture): 10 parts, or 7 ozs. (equals 3 ozs. dry matter).
Slaughterhouse waste or condemned meat (70 per cent. moisture): 25 parts, or 18 ozs. (equals 8 ozs. dry matter).

* Donald, H. P.: "Home Grown Foods for Fattening Pigs," *Scot. J. Agric.* (1942). *XXIV*,-1, 60-66.

Dried yeast : 5 parts, or 1½ ozs.
Minerals (1.5 parts chalk and 0.5 parts common salt) : 2 parts.

Of the material which is to be fed to capacity, potatoes are most satisfactory, but they should be boiled. Boiled potato peelings are almost as good as the whole tuber in spite of the high proportion of fibre which a chemical analysis would show, because about 80 per cent. of it is digested by the pig. One of the greatest virtues of potatoes as a food is that they improve the quality of the carcase, and so, to a great extent, mitigate the effect of low-class ingredients with which they may be fed.

Concentrated urban swill has proved very satisfactory when fortified by an appropriate basal ration. Dried sugar beet pulp fed under the same conditions and with the usual precautions is also suitable. Whey forms an excellent bulky food for those who are lucky enough to get it, and in such circumstances the feeder might be justified in taking in hand for fattening a pig of 50 lb. or even younger.

Household and garden waste does, however, usually form the bulk of the back-yarder's food, and although it is always advantageous and, in the end, economical to boil the material until it can be easily consumed by the pig, one should keep in mind that a certain amount of raw green stuff should be offered regularly, the amount being governed by the appetite of the pig for it and the condition of the animal's bowels. In any case, the skill of the feeder, as expressed in his ability to vary the diet in accordance with the pig's needs and desires, and the time and interest he is prepared to devote to the subject, play a far larger part in the successful management of the back-yarder than it does when pigs are kept under more favourable conditions.

## Clinical

### LEAD POISONING

By DAVID McKELVEY, M.R.C.V.S., D.V.S.M.,
*Lisburn, Northern Ireland*

Series I

*Subject:* Bullock, 2½ years old.

*History:* On the evening of October 20 the bullock was noticed dull and was brought into a shed. Next morning, October 21, the animal was apparently all right and was returned to the pasture. About two hours later it was seriously ill and I was sent for.

*Symptoms:* Temperature 104 deg. Fahr. Blindness, staggering gait, salivation, blackish diarrhœa. Acute cerebral disturbance; the bullock walked against the wall and stood with his head in the corner. The respiratory rate was greatly increased.

Death occurred within three hours.

On October 22 a second bullock took ill suddenly. This bullock was going round in a circle in the field, galloping as fast as it could, bellowing continuously, with frothy saliva pouring from its mouth. After about ten minutes of this

frantic galloping it fell and lay for a minute or two, and then got up and galloped again. It collapsed in a few minutes and was held down until its temperature was taken. This was found to be 110 deg. Fahr. The thermometer was shaken down and the temperature taken again, but there was no mistake, the temperature was 110 deg. Fahr. This bullock was also blind. It died five minutes later.

On the morning of October 24 another bullock was found dead. Skin wounds indicated that it had been in contact with the barbed wire. Post-mortem examinations showed some abomasitis and enteritis. The contents of the abomasums of bullocks 1 and 3 were submitted to the analyst. His report was that in the sample from No. 1 the percentage of lead present was 1.73 and in No. 3 the percentage present was 0.97.

The owner stated that another bullock had died on October 20.

The source of the lead was jointing material which had been used in laying drain pipes across the field in which the cattle had been grazing.

**Series II**

*Subjects:* Two cross-bred cows.

*Date:* October 22, 1942.

*History:* The owner had spilled some red oxide of lead over the fodder, but did not think it would harm the cows.

*Symptoms:* Temperature 100 and 101. Animals very dull and off food. Cudding absent and bowels inactive. Salivation was present. The extremities were cold. One cow was moaning and each moan was extraordinarily long drawn out. Each cow was given ½ lb. mag. sulph. followed by 1 pint liquid paraffin and stimulants.

On October 23 the symptoms were much the same and the peculiar long drawn out moans were very much in evidence from the moaning cow. Liquid paraffin and stimulants were again given.

On October 24 both cows were moaning. Temperatures 99.5 deg. Fahr. and 100 deg. Fahr. A small quantity of thin fæces were passed by both cows. Liquid paraffin and stimulants were again given.

On October 25 one cow was showing cerebral symptoms. This cow adopted a kneeling position for upwards of half an hour. The second cow also developed symptoms indicating involvement of central nervous system. Both cows died later this day.

**Series III**

*Subjects:* Three calves.

*History:* On July 11 I was asked to see some year-old calves. On arrival one calf was found dead, a second calf was ill and blindness had developed. This calf was semi-comatose and remained kneeling for considerable periods. Temperature 100 deg. Fahr. This calf died later in the day.

Three days later a third calf died

Post-mortem examination showed abomasitis. Particles of metallic lead were present in the contents of the rumen (confirmed by analyst).

*Source of lead:* Some material used in repairing a damaged house had been dumped in the field on which the calves were. This contained lead. The calves had ingested some material from this dump.

## Abstract

### EQUINE VIRUS ABORTION*

By W. W. DIMOCK, P. R. EDWARDS and D. W. BRUNER

THE following is a fairly full summary of this *Bulletin*:

"Since 1932 the authors have studied 19 outbreaks of abortion in mares, including 119 abortions, in which the pathological changes in the aborted fœtuses and the absence of cultivable micro-organisms in their tissues definitely identified the disease as virus abortion. The pathological changes noted in the aborted fœtuses were small necrotic areas in the liver, hæmorrhages on the thoracic and abdominal viscera and an accumulation of fluid in the pleural cavity. Intranuclear inclusion bodies were present in the liver and lungs. No such inclusions were found in the tissues of fœtuses not affected with virus abortion."

The 19 outbreaks referred to all occurred in Kentucky. The authors also say that the disease is known to exist in Virginia and California, and probably in other parts of the United States and in Canada. They cite literature concerning the occurrence of the disease in Germany, Jugoslavia and Hungary.

A description of the outbreaks is given. The abortions have been found as early as the sixth month of pregnancy, but they more usually occur during the eighth, ninth and tenth months. In mares infected late in pregnancy the foals may be born dead or alive at full term; the latter usually die within 36 hours. Mares about to abort do so, as a rule, without showing premonitory symptoms of foaling: there is no enlargement of the udder, etc., except the mare be well advanced in pregnancy. The mare appears normal in health and the first sign of the infection is the expulsion of the fœtus, from which the mare usually rapidly recovers. As a rule, there is no retention of the fœtal membranes. The authors found 10 to 85 per cent. of the mares affected in the different groups. The incidence and frequency of the abortions depended on the state of pregnancy of the mares when the infection was introduced and the methods of segregation, etc. "The disease seems to be rather highly contagious, since, on several occasions, it has been observed to spread from one group of mares to another on the same farm, where there was no direct contact between the two groups. It should be emphasised that in all the outbreaks observed the mares which aborted had not all been bred to the same stallion, and there was no evidence of a relation between the occurrence of the disease and the stallion to which the mare was bred. Apparently the stallion plays no role in the transmission of the infection." The disease has not occurred on any farm in two successive years, though there are records of its occurrence on the same farms after a lapse of three to five years. If immunity is acquired it does not seem to be permanent: mares are known to have had second attacks two, three or four years, respectively, after the first attack.

All fœtuses and foals were subjected to extensive bacteriological examinations with consistent negative results. "Occasionally a fœtus which displayed the pathological changes characteristic of virus abortion yielded streptococci on culture." The authors explain their presence by stating that "such cases represent virus abortion infection in mares which harboured pre-existing streptococcic

* Abstracted from the *Kentucky Agr. Exp. Stn. Bulletin 42b.* Lexington, Kentucky. June, 1942.

infections of the genital organs." They found that in mares which become infected with virus later in pregnancy, and which give birth to live foals, the recovery of hæmolytic streptococci and *Shigella equivulis* from the foals' tissues is often possible: such foals also showed the pathological changes due to the virus—the authors are of opinion that the organisms may be evidence of " post-natal invasion due to the lack of resistance induced by virus infection."

The pathological changes in the fœtuses, foals and membranes were not always all present. In the aborted fœtus ascites and jaundice were evident. " The congested state of the liver, along with pressure on the diaphragm from serous fluid within the thoracic cavity, produced an aspect of ascites when no appreciable accumulation of fluid was present in the peritoneal cavity." The organs in the abdominal cavity and the joint cavities and foot pads were icteric. " The liver showed the most striking changes and thus the most dependable diagnostic, macroscopic lesion. Beneath the capsule of the liver were pinhead-sized whitish to yellowish areas of necrosis. When present, the necrotic areas varied from a few to large numbers. In some instances they were scattered over the whole surface of the liver, while in others they were more or less limited to individual areas and lobes. These degenerated foci ranged in size from the border of visibility up to 2 mm. in diameter." Similar spots were seen in " dispersed locations within the parenchyma of the organ." The spleen was hyperæmic and had many petechial hæmorrhages on the surface. The colic lymphatic glands were enlarged, congested and often hæmorrhagic. The thoracic cavity often contained much serous fluid and the lungs were œdematous and congested and had many petechial hæmorrhages on the surface. Œdema seemed to be confined to the subcapsular and interstitial lung tissues. Sometimes there was an increase of pericardial fluid and numerous petechiæ below the epicardium, mostly confined to the ventricles, following the coronary groove and left longtitudinal groove of the heart. The most pronounced changes in the fœtal membranes were in the amnion, which was " œdematous in various areas, if not throughout its entity, and was often straw coloured." All fœtuses did not show all these changes. " On gross examination, areas of degeneration were apparent in the livers of 82.2 per cent. of the fœtuses. Hæmorrhages occurred beneath the epicardium of 66.3 per cent., while an excessive amount of fluid was observed in the thoracic cavities of 59.6 per cent."

In the liver and lungs the most significant microscopic lesions were found. In some cases it was only on microscopic examination that " changes were sufficiently characteristic to justify a diagnosis of virus infection." In sections of the liver there was often found marked hyperæmia with hæmorrhages in some cases. The areas of degeneration were intralobular and were found to vary in situation from the border of the central vein to the periphery of the lobule. Some were very small, others occupied the whole lobule. They were numerous or few, and diffuse or discrete. " The typical lesion in which the inclusion bodies were found was an area of focal necrosis with varying degrees of karyorrhexis and pyknosis present. Degeneration and destruction of the parenchyma of the liver was evidenced by the accumulation of cellular debris. These lesions were very characteristic and intranuclear inclusions were found in hepatic cells lying in the periphery of the necrotic areas." The lungs showed degrees of hyperæmia and hæmorrhage. Inclusion bodies were found in the cells of the epithelium

lining the bronchi, bronchioles and alveoli. The number varied, but were more numerous in the nuclei of epithelium lining the terminal air passages and in the cells of the alveolar walls. "The most characteristic location within the lung tissue, however, was in the epithelium of the bronchioles."

[A description is given of the inclusion bodies with staining characteristics.]

Transmission experiments were carried out, using mice, rabbits, guinea-pigs and mares. A variety of tissue was used for this purpose. No positive results were found in mice or rabbits, and though there appeared to be some evidence of infection in guinea-pigs following the injection of filtrates of fœtal membranes and organs, the authors concluded that: "Apparently virus abortion of mares cannot be transmitted regularly to these animals." The experiments with mares were interesting. In all, 24 pregnant mares were used. Nine were fed and injected with unfiltered material from aborted fœtuses—membranes, fluids and organs. All nine did not receive the same material. Two mares aborted, 27 and 28 days, respectively, after inoculation, and the fœtuses showed the characteristic changes of the disease. Ten pregnant mares were fed and injected with filtered material. Three mares aborted, 18, 23 and 34 days, respectively, after inoculation. Three mares were used in experiments on stall exposure. One of the mares, which was given the same feed and water as an infected mare, and into whose stall fœtal membranes of aborted fœtuses were placed and left for some hours, aborted after 24 days, and the fœtus showed typical disease. There was also evidence that infection was carried by an attendant from infected fœtuses to a pregnant mare.

Experiments carried out with developing chick embryos failed to show evidence of propagation of the virus.

A section of the article deals with "Treatments for Immunisation of Mares." Convalescent serum was used prophylactically as well as serum from affected mares injected with material from aborted fœtuses. The author states that: "In some instances apparently good results were obtained and no further abortions occurred after the administration of serum. In other cases a few mares aborted soon after the serum was injected and then the outbreak stopped. In still other bands of mares it was evident that the serum had no effect on the course of the outbreak." Vaccine, prepared from the livers of affected fœtuses, was used in attempts to immunise mares. "Preliminary field trials with it have given very encouraging results." The final section deals with "Observations on the Transmission and Control of Equine Virus Abortion."

*Conjectured mediums of transmission.*—The following are cited: Related to the water supply; feeding corn stover; use of mouldy straw for bedding, rye pasture, and to pennyroyal abundant in native hay fed to the mares; presence of Bang's disease in the cattle; ergot in the hay or straw. Commenting on these notes, the author says: "Inasmuch as equine virus abortion is due to a specific filterable virus seemingly not readily transmissible to animals of other species, it would hardly appear likely that it could be contracted in the foregoing ways. The possibility that it might, however, should not be overlooked."

*Horses evidently not chronic carriers.*—The author comes to this conclusion because (1) the disease has not been found on the same farm in successive years; (2) no evidence that the stallion is connected with the disease; (3) infected mares did not act as carriers when sent to other farms and placed with susceptible

mares; (4) when the disease appeared on a farm where mares were boarded it usually appeared first among mares bred on the farm.

*Practical applications for handling brood mares.*—The mare which has aborted spreads infection. The author gives details of dealing with infected mares, their stall, bedding, etc., pointing out also that the methods used in the control of the disease depend upon a number of instances. "If only a small group of mares is stabled with the infected mare they probably should not be moved. If the disease occurs late in the foaling season, and the mares are within three weeks of term, they should not be moved. If a large group of mares is concerned, it is advisable to divide them into smaller groups if suitable unaffected quarters are available. In this case they should be divided into groups according to the period of gestation. Those which are to foal within three weeks may be left in the original barn. Those to foal at later dates may be moved to available stables. Indiscriminate moving of mares each time a case of abortion occurs is to be discouraged." The author adds that the above, together with the use of convalescent serum and tissue vaccine, represents the extent of our present knowledge concerning the control of the disease. The period during which a mare may continue to disseminate the virus after she aborts is not known, therefore it is advisable to wait as long as possible before the mare is admitted to service. Similarly, it is necessary to ensure that the reproductive organs are normal. The possibility of horses being chronic carriers of the infection must not be overlooked.

## Abstract of Current Literature

**Observations of Leptospirosis in California Dogs.** By ERNEST A. DUGAL. *Vet. Med.* XXXVII, *10*, 435-436.

LEPTOSPIROSIS is becoming more prominent in the field of veterinary medicine as well as that of public health.

Two species of spirochæte have been isolated from positive cases in dogs, i.e., *Leptospira canicola* and *Leptospira icterrohæmorrhagiæ*.

Leptospirosis can be classified into two groups: the icteric type caused by *L. icterrohæmorrhagiæ* and the gastro-enteritis type caused by *L. canicola*. The two types are clinically alike except that a generalised jaundice is associated with *L. icterrohæmorrhagiæ* infection.

The author gives a typical syndrome.

*History:* Dogs, usually two or nine years old, predominantly males, inappetence for two or nine days. Emesis noticed occasionally. The animals are depressed and are still most of the time, but surprisingly agile when allowed to exercise.

*Symptoms:* Temperature on admittance 102.5 deg. to 104.5 deg. Conjunctivæ congested; usually no discharge from eyes or nose. Fœtid odour from mouth and occasionally a "pink coating" covering the teeth.

Inappetence and occasional emesis.

Later, vomitus became tinged with blood and onset of bloody diarrhœa. The temperature drops, maybe to 100.5 deg. The author considers this drop to be very characteristic of the disease. The odour from the mouth became more fœtid, and ulcers developed on the gums and mucous membranes of the mouth.

Great depression, and the appetite completely gone. At this stage great dehydration and emaciation. From this stage the disease would run a rapid course. If jaundice was present this type was usually fatal.

Methods of diagnosis are discussed. Positive diagnosis evidently depends upon an agglutination test and microscopic examination by the aid of dark field illumination.

*Post-mortem:* gastro-enteritis always present. Otherwise no characteristic lesions.

*Treatment:* Steps to overcome dehydration and the use of hyper-immune serum. The latter giving good results in early stages of the disease.

British practitioners have been familiar with the icteric type since it was first described by Dalling, Pugh and Okel, but probably have not met with Leptospirosis in which the predominant feature is a gastro-enteritis and in which jaundice is not present.

## Review

**The Physiology of Domestic Animals.** By H. H. Dukes, D.V.M., M.S., Professor of Veterinary Physiology, New York State Veterinary College, Cornell University. Fifth Edition. Revised. 33s. 1942. Comstock Publishing Company, Ithaca, New York. Baillière, Tindall & Cox, London.

One of the minor tragedies of modern life is that almost as soon as we get on familiar and real friendly terms with a textbook or reference book we have to break the association, for the book is superseded by a new edition. This is so particularly in respect of those books which deal with physiology, for our knowledge is ever widening, progress being made from day to day.

Dukes' " Physiology " is no exception to this rule. It has not had a chance to become well thumbed. The fact that a fifth edition is required within a period of nine years bears testimony to the appreciation of its public and also to the progress of the science which it records.

Physiology is the science which largely depends upon observations made upon animals, yet it was not until the publication of Dukes' book in 1933 that English-speaking veterinary surgeons had at hand a textbook which gave especial attention to the domestic animals. In this edition new material has been added and much has been revised and rewritten.

Chapter XVII, dealing with Digestion in the Chicken, is new and especially welcome, but why should the term " chicken " be used rather than " fowl "? The chapters included in Part X deal with the endocrine organs and reproduction. An excellent résumé of present-day knowledge is given which should be of great service to the modern practitioner. It is strange that, in a book of such scope and size, the rôle of minerals, water and vitamins in metabolism can be compressed within the limits of twenty pages.

One would like to see more illustrations of the type of Figs. 111 and 150. The author has had the assistance of collaborators who are authorities in their own particular spheres. The list of references are a record of great diligence and should be of great value to those who would delve further. We can confidently recommend the book to all interested in physiology, and particularly to those interested in veterinary physiology, i.e., veterinary surgeons, teachers and undergraduates.

## Obituary

### HUGH TUDOR HUGHES, B.Sc., F.R.C.V.S.

THE news of the death of Tudor Hughes on December 3, 1942, came as a great shock to his friends and colleagues, especially so to those who did not know that for some months he had been in serious ill-health. A profession can ill-afford to lose men of the calibre of Hughes. From the very day that he entered the Royal Veterinary College as a Class A student he gave evidence of great ability, and this reputation was enhanced by the passing years. As a student he was outstanding, and that in a period which might be said to be of the best vintage. He was Fitz Wygram prizeman for the year 1907. He seemed to be well fitted for an academic career, but chose to join his father in practice at Oswestry. He was a great success, an asset to his district, and he brought honour to his profession. Throughout his life he took an active interest in the science and politics of his calling. He was a regular and active member of the professional societies, being one of the pillars of the Midland Counties Association, which he represented on the Council of the N.V.M.A. When he spoke he always drew full attention, for his audience knew instinctively that there would be something worth listening to, it would be to the point and there would be no waste of words. Many professional appointments came his way, but the one which probably gave him greatest pleasure was that of Examiner for the R.C.V.S. As a rule, those who have behind them a good academic career are good examiners. Hughes was no exception to the rule. There was nothing "finicky" in his questions, the students would soon realise that they were in the presence of a kind, decent chap, and so give of their best.

Hughes was a big man, physically and mentally, who went through life with a cheery optimism. Success and renown were his by right, reverses only served to spur him to greater effort. His final battle was one from which many would shrink, but those who knew the man best can be certain that he took the risks in great heart, fully prepared for whatever might be the outcome.

He has passed on whilst still in his prime, but not before he had made a mark in his profession which will never be erased.

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